

COMMENTS MATRIX

Draft IS-GPS-800, dated 6 April 2006

Item #	Class	Comment/Suggested Change/Rationale	A/AC/D/R
1	C	<p>Page 34, para 3.4.1, line 1: Comment: I see no SMC/GP programmatic justification, and no AFSPC/DR requirement, for the statement “The GPS CS shall control GPS time scale to be within 40 nanoseconds (99% probability) of UTC(USNO) (modulo one second).” Suggested Change: <u>Replace</u> with “The navigation message shall broadcast an offset of the GPS time scale relative to UTC(USNO). This offset, modulo one second, shall be within the range of ± 950 nanoseconds.” Rationale: For one, this is a space-to-user interface document, not a control-to-user interface document. Secondly, the bit space in the navigation message, if I interpret Table 3.5-3 correctly, explicitly permits a range of values of approximately ± 953.64 nanoseconds. Unless you can provide supporting documentation to conclude otherwise, I believe users would experience no benefit from a tighter constraint of 40 nanoseconds, and this document should not commit to unnecessarily tighter constraints.</p>	<p>D: While it is true that there should be no difference to users as long as the offset is broadcast to users and users implement the correction, this tighter constraint is a GPS III requirement from SS-SYS-800 paragraph 3.2.1.10. This comment will be forwarded to the GPS III requirements group for a consideration.</p>
2	C	<p>Page 34, para 3.4.1, line 2: Comment: I see no SMC/GP programmatic justification, and no AFSPC/DR requirement, for the statement “The accuracy of the data during the data transmission interval shall be such that it shall relate GPS time to UTC(USNO) to within 1.5 nanoseconds (RMS over 30 days).” Suggested Change: <u>Cite</u> (to the reviewer) a specific requirement document identifying, and thus providing rationale for, this statement. Rationale: Lack of rationale for this I.S. statement.</p>	<p>A: The statement in IS-GPS-800 is a GPS III requirement from SS-SYS-800 paragraph 3.2.1.9.</p>
3	C	<p>Page 59, para 3.5.4.2.1.1, line ALL: Comment: This paragraph makes no reference to integer second differences between GPS time and GNSS time scale types. As a result, this IS, whether intentionally or not, imposes an inferred requirement on all referenced GNSS types such that all referenced GNSS types shall have an integer second offset from GPS time of, without exception, zero (0) seconds. Suggested Change: <u>Investigate</u> the validity of this inferred requirement. If such an inferred requirement proves to be invalid, change the structure of this interface specification so as to permit non-zero integer second differences between GPS time and the respective GNSS time scale types. Rationale: I’m not convinced that all GNSS types have committed to conforming each respective GNSS time type to GPS time in this fashion. Where is this International Accord that documents this kind of commitment?</p>	<p>A: The paragraph will be updated to account for integer second difference.</p>
4	C	<p>P7/3.2.1.6/line 2: Suggest that “within ± 100 milliradians” is too loose a specification of phase accuracy. Change to read as “within $\pm \text{TBD}$”</p>	<p>D: “± 100 milliradians” is the current requirement. This requirement may be changed when a better requirement is identified with justification.</p>

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5	C	P9/3.2.1.9/line 2: Change “3 dBi linear polarized” to read as “0 dBi ideal RHCP (i.e., 0 dB ellipticity)”, suggested to be consistent with ICD-GPS-700	R: “3 dBi linear polarized” is consistent with IS-GPS-200, IS-GPS-705, and other international RF compatibility documents.
6	C	Page 32, para 3.3.1, line #: Comment: The combining technique is TBD. This affects all signals and should be left up to the provider as long as the other performance numbers (Correlation loss, etc.) are met. Requirement currently specing implementation. Suggested Change: Delete. Rationale: Constraining the combining technique locks in a combining loss. If flex power (moving code power from one signal to another) feature is used, there may be more efficient methods for combining the 5 signals.	AC: This section will be deleted for now. However, this section may be re-introduced or other sections may be updated in future.
7	C	Page 6, para 3.2.1.2 , line #: Comment: Propose change to this requirement. Reqt states “The transmitted signal shall be Right-Hand Circularly Polarized (RHCP). For an angular range of +14.3 degrees from boresight, the L1 ellipticity shall be no worse than 1.2 dB.” Suggested Change: Change value to 1.8 dB (same as IS-GPS-200D for Block IIR/IIR-M/IIF). Rationale: This requirement is in conflict with other issued ICD’s governing other signals transmitted on the L1 channel. Since the same antenna is used for these signals, only one specification can be used. Specifying a value of 1.2 dB precludes the use of proven performance from heritage antennas.	A: The value will be changed to 1.8 dB.
8	C	L1C Should Incorporate Cryptographic Authentication Features Following report presents arguments in favor of and methods for implementing	D: This recommendation will be considered in the decision process of the GPS JPO.
9	C	Missing: Definition of a deterministic repetition rate of each page in subframe 3 such that the user can determine the maximum time between unique pages of subframe 3. Rationale: Users need to know what to expect in regards to the minimum transmission of each subframe 3 page. As a receiver, we want to know how long to listen to get the whole message. The only rates that I can find in regards to subframe 3 pages are the frequency of updates by the CS.	D: Broadcast sequence of subframe 3 pages is designed to be flexible and is not currently fixed to any deterministic pattern or rate. Moreover, new subframe 3 pages may be added in future. However, maximum broadcast intervals (i.e. worst case repetition rate) may be added at a later time.

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10	S	<p>Page 48, para 3.5.3.2, line 1:</p> <p>Comment: The statement “The epoch occurs at (approximately) midnight Saturday night-Sunday morning, where midnight is defined as 0000 hours on the UTC scale that is normally referenced to the Greenwich Meridian.” by itself is, at best, misleading, and at worst, incorrect.</p> <p>Suggested Change: <u>Add</u> the sentence, “The time differences between a) this epoch and b) 0000 UTC Sunday, can be as a result of time scale differences between the SV CLOCK, GPS time, and UTC.”</p> <p>Rationale: A reader could interpret the statement as being in direct conflict with paragraph 3.4.2, which defines timing relationships.</p>	<p>AC: A sentence will be added to state, “The occurrence of the “zero state epoch” may differ by a few seconds from 0000 hours on the UTC scale since UTC is periodically corrected with leap seconds while GPS time is continuous without such correction.”</p>
11	S	<p>Page 7, para 3.2.1.5, line 2:</p> <p>Comment: As written, the text would allow a very bad spacecraft output.</p> <p>Suggested Change: Change “The minimum correlation...” to read “The maximum correlation...”.</p> <p>Rationale: Correlation loss is traditionally (IS-GPS-200) stated as worst case and thus this allocation should be a maximum, not a minimum.</p>	<p>AC: The sentence will be revised to state, “The correlation loss.....0.2 dB maximum.”</p>
12	S	P6/3.2.1.1/line 4-5: Why do we even need to specify the offset due to relativity? If clock offset is specified, should specify offset on carrier frequency also.	<p>AC: The offset is specified for satellite manufactures.</p>
13	S	P7/3.2.1.7/line 6: Change “1/1.023” to read as “0.5/1.023”. Should there be a similar statement for BOC(6,1), if TMBOC is used?	<p>A: It will be changed to read as “0.5/1.023”.</p>
14	S	P20/3.2.3.1/line 4: Change “clock and ephemeris data” to read as “clock, ephemeris data, and CRC”. This is made evident in later material, but I suggest it here for clarity	<p>AC: It will be changed to read as “clock and ephemeris data with CRC”.</p>
15	S	P20/3.2.3.1/line 5: Change “nonvariable” data” to read as “nonvariable”data and CRC”. This is made evident in later material, but I suggest it here for clarity	<p>AC: It will be changed to read as “variable” data with CRC”.</p>

Item #	Class	Comment/Suggested Change/Rationale	A/AC/D/R
16	S	<p>Page 1 Paragraph 1.1 Scope states in part: <u>This Interface Specification (IS) defines the characteristics of an open access signal transmitted from Global Positioning System (GPS) satellites to navigation receivers on radio frequency (RF) link 1 (L1). While there are multiple open signals broadcast within the frequency band of L1, this IS defines only the signal denoted L1 Civil (L1C). Throughout this document, the L1 carrier denotes 1575.42 MHz.</u></p> <p>Comment: There is a practical upper limit to the number of open access signals that can be transmitted on a given carrier and associated band width.</p> <p>Suggested Change: WAS: This Interface Specification (IS) defines the characteristics of an open access signal transmitted from Global Positioning System (GPS) satellites to navigation receivers on radio frequency (RF) link 1 (L1). While there are multiple open signals broadcast within the frequency band of L1, this IS defines only the signal denoted L1 Civil (L1C). Throughout this document, the L1 carrier denotes 1575.42 MHz.</p> <p>NOW: This Interface Specification (IS) defines the characteristics of an <i>assigned</i> open access signal transmitted from Global Positioning System (GPS) satellites to navigation receivers on radio frequency (RF) link 1 (L1). While there are multiple open signals broadcast within the frequency band of L1, this IS defines only the <i>assigned</i> signal denoted L1 Civil (L1C). Throughout this document, the L1 carrier denotes 1575.42 MHz.</p> <p>Rationale: There must be some control of the time slot, power and the bandwidth of the “open access” signals to avoid errors due to cross correlation with the “independently transmitted” signals.</p>	<p>R: The statement addresses “an open access signal transmitted from GPS satellites”. Moreover, the paragraph goes on to state that it is addressing a specific signal called L1C. There are no “unassigned” open access signal from GPS satellites.</p>
17	S	<p>Page 7, para 3.2.1.5, line #:</p> <p>Comment: 1. The correlation loss is specified as a minimum and; 2. is significantly lower than the IS-200 and IS-700 numbers.</p> <p>Suggested Change: Maximum loss same as P(Y) and C/A code (0.6 dB) for SV.</p> <p>Rationale: 1. Specs should bound the worst case loss and hence, maximum is appropriate. 2. SV processing that causes correlation loss is equivalent for C/A, P(Y), and L1C.</p>	<p>AC: The loss will be specified as a maximum. The true imperfections should be something far better than 0.6 dB and, as such, the new future requirement is 0.2 dB.</p>
18	S?	<p>When describing GPS weeks on pg. 34 of IS-GPS-800, a GPS week is described as having a range to 604,800. “The largest unit used in stating GPS time is one week defined as 604,800 seconds, concatenated with the GPS week number.” On pg. 53 (IS-GPS-800) t_{oc} from IS-GPS-200 is to be replaced with t_{oe} from IS-GPS-800 yet t_{oe} has an effective range of 604,500 and t_{oc} has an effective range of 604,784 (IS-GPS-200 Table 20-I. Subframe 1 Parameters). Page 45, Table 3.5-1. Subframe 2 Parameters (1 of 3) of IS-GPS-800 indicates an effective range of 604,500 for t_{oe}. Should 604,500 be 604,800 or 604,784? Throughout I don’t understand why the range is 604,500 for some, 604,784 for others and 604,800 for others given definition on pg. 34 of a GPS week. My confusion is generated in IS-GPS-200 and maintained in IS-GPS-800.</p>	<p>AC: The difference is due to scale factor of each parameter. In addition, although there are 604,800 seconds in a week, the count goes from 0 to 604,799. As such, for t_{oc}, the scale factor is 16 seconds and its range need only be from 0 to 604,784. Similar analogy applies to t_{oe} and 604,500.</p>
19	S	<p>Page 52 Table 3.5-2. Add equation for A_k as is found in ICD-GPS-700A in Table 20-VI on page 101. $A_k = A_0 + A \cdot DOT \cdot t_k$ (<i>Semi-major Axis</i>).</p>	<p>AC: The equation for A_k is already provided in Table 3.5-2 (part 1 of 2) on page 51.</p>

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20	S	<p>Missing: Page 20, 3.2.3 Message Characteristics Please add the following. If it is true, it needs to be explicitly stated: <i>The first LIC_D transmission begins at the beginning of the GPS week rollover. Subframes 1, 2, and variable pages from subframe 3 are continuously transmitted on LIC_D. The content of data within the subframes will change every 2 hours to include new data that is valid for the 2 hours it is transmitted and one additional hour that overlaps the next data set transmission.</i></p>	AC: This information is already provided in Section 3.5.3 on page 44 and paragraph 3.5.3.2 on page 48.
21	S	<p>Page 10, para 3.2.2.1.1, line 4-6 Comment: Although looks mathematically concise, implementation is not obvious (2^{5115} is too big a number for most computers today). We had verified the codes based on an algorithmic description of Legendre Sequence Generation which we found easier to use. Suggested Change: Add the following. For any odd integer prime p, the Legendre sequence Leg is defined as a $+1/-1$ sequence of period p indexed with i from 0 to $p - 1$ and</p> <ul style="list-style-type: none"> • $Leg_p(0) = -1$ • $Leg_p(i) = +1$, if there exists some integer x such that i is congruent to x^2 modulo p (i is a <i>quadratic residue mod p</i>) • $Leg_p(i) = -1$, if there is <u>no</u> integer x such that i is congruent to x^2 modulo p (i is a <i>quadratic nonresidue mod p</i>) <p>For example, modulo 7, the quadratic residues are 1, 2, and 4 (e.g., 3^2 is congruent to 2 mod 7, etc.). Therefore,</p> <p style="text-align: center;">$Leg_7 = (-1, +1, +1, -1, +1, -1, -1)$</p> <p>(note that indexing starts at zero).</p> <p>Rationale: This format helps facilitate making the requested change.</p>	AC: The algorithm description will be updated appropriately for further clarification.
22	S	<p>Page 18, Figure 3.2-1 Comment: Figure is not clear. We suggest add the following Figure after Figure 3.2-1.</p> <p>Figure shown on next page.</p>	D: Figure 3.2-1, together with equations of Section 3.2.2.1.1, should provide clear description of the algorithm. The figure attached to this comment is not an accurate depiction of the algorithm. The current figure in the IS will be further evaluated for any possible update.
23	S	<p>Page 5, para 5, line 1: Comment: Recommend adopting BOC(1,1) and not TMBOC technique Suggested Change: Delete from “OR” to end of paragraph Rationale: Simplify SS-US Interface. This technique does not appear to provide any benefit to our user base</p>	D: This comment will be considered in the decision process of the GPS JPO.

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24	S	<p>Page 8, para 3, line 5: Comment: Suggested Change: In Section 3.2.1.8.2, change “3 nanoseconds” to “1 nanoseconds” or clarify overall group delay residual uncertainty including group delay uncertainty (Section 3.2.1.8.1) is 3 nanoseconds, 2 sigma Rationale: The differential group delay specified in 3.2.1.8.2 is as high as the L1-L2 inter-frequency group delay specified in IS-200, and is higher than the C/A-P mean delay observed by Pini, et. Al. (“Analysis of GNSS Signals as Observed ...”), ION GNSS 2005.</p>	<p>D: The referenced paper does not provide adequate justification or need to change the current requirement. However, this requirement will be further evaluated by the GPS JPO for possible update.</p>
25	S	<p>Page 9, Table 3.2-1, row 3 columns 5 and 6 Comment: Recommend raise L1CD power to equal L1C/A Suggested Change: Change “-163” to “-158.5”; “-188.5” to “-183” Rationale: In order to provide equivalent signal power to the L1 C/A for users that require continuous data demodulation (e.g., safety of life).</p>	<p>R: Available power from SV is limited and L1CD with FEC provides better data demodulation performance than L1 C/A.</p>
26	A	<p>Page ALL, para ALL, line ALL: Comment: General: The provided format, .pdf, doesn’t appear to permit copying and pasting. Suggested Change: <u>Provide</u> reviewers documents that explicitly permit text copying and pasting. Rationale: The current review process, because of the provided format, a) makes the review process inefficient, b) incurs risk of typographical transcription error, and c) discourages reviewers from the review process, thus inhibiting the stated objectives of the review.</p>	<p>AC: A distribution of documents in a pdf format has its pros and cons. While the stated comment is one of the cons of this distribution method, there are other pros and considerations that favor this distribution method.</p>
27	A	3.4.1, 1 st sentence – “... as maintained by ...” should be “... as realized by ...”	A
28	A	Global issue with many locations (search for ‘two’s complement’ to find them all) – This is an improper wording or definition of two’s complement throughout the document. It is often stated that “two’s complement with the sign bit ...” or “signed, two’s complement”. Two’s complement is a way of storing a signed integer without the use of a sign bit but it is stated in the text that it is using a sign bit. The proper wording would be something like “a signed integer stored in two’s complement notation” or “a two’s complement signed integer”.	A: The IS will be updated appropriately.
29	A	P9/3.2.1.9/line4: Change “using 0.5 dB” to read as “assuming 0.5 dB”	A
30	A	P21/3.2.3.1/Figure 3.2-3: Arrow showing “direction of symbol flow” confuses me. Should it point in the other direction?	AC: The shown “direction of symbol flow” is correct and consistent with IS-GPS-200 and IS-GPS-705. The arrow direction shows that the “first” bit of a message is transmitted by a satellite first.

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31	A	P29/3.2.3.5/Fig 3.2-6: Arrow showing “direction of data flow” confuses me. Should it point in the other direction?	AC: The shown “direction of symbol flow” is correct and consistent with IS-GPS-200 and IS-GPS-705. The arrow direction shows that the “first” bit of a message is transmitted by a satellite first.
32	A	P35/3.5.1/line 1: Change “since” to read as “since after”. There is ambiguity about definition of number of epochs that actually is cleared up later	R: “Since” is the correct word to use to denote “after a time in the past”.
33	A	P35/3.5.1/line 4: Change “since” to read as “since after”. There is ambiguity about definition of number of epochs that actually is cleared up later	R: “Since” is the correct word to use to denote “after a time in the past”.
34	A	P36-43/3.5.2/Fig 3.5-1 to Fig 3.5.8: Arrow showing “direction of data flow from SV” confuses me. Should it point in the other direction?	AC: The shown “direction of symbol flow” is correct and consistent with IS-GPS-200 and IS-GPS-705. The arrow direction shows that the “first” bit of a message is transmitted by a satellite first.
35	A	Page 1, para 1.3, line 12: Comment: Text says that a PIRN is submitted to the CCB. The GP OI for CCB (CZ OI 63-1101, 15 Feb 02) says that when the ICWG has coordinated on a PIRN, they submit it to the CCB as an IRN. Suggested Change: From “The ICWG coordinated PIRN must be submitted to the GPS JPO CCB for review and approval.” To “The ICWG coordinated PIRN must be submitted as an IRN to the GPS JPO CCB for review and approval.” Rationale: See Fig. 3 and para. 6.1.10 in CZ OI 63-1101. Also see GP-03-001, ICWG Charter, 14 Nov 03, para. 5.4.2.	A
36	A	Page 5, para 3.1, second paragraph, line 3 and 4: Comment: Define NSCP and NSCD in Section 6.1 Acronyms. Suggested Change: Rationale:	A
37	A	Page 5, para 3.1, fourth paragraph, line 5: Comment: Define TMBOC in Section 6.1 Acronyms. Suggested Change: Rationale:	A
38	A	Page 10, para 3.2.2.1, second paragraph, line 3: Comment: Define GBAS and SBAS in Section 6.1 Acronyms. Suggested Change: Rationale:	A

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39	A	Page 50, para 3.5.3.6.1, title and line 2: Comment: Define EOP in Section 6.1 Acronyms. Suggested Change: Rationale:	A
40	A	Page 60, para 3.5.4.2 line 1: Comment: Define APC in Section 6.1 Acronyms. Suggested Change: Rationale:	A
41	A	Page 67, para 3.5.4.4 line 1: Comment: Define DC in Section 6.1 Acronyms. Suggested Change: Rationale:	A
42	A	Page 67, para 3.5.4.4.1 line 2 and 3: Comment: Define CDC and EDC in Section 6.1 Acronyms. Suggested Change: Rationale:	A
43	A	Page 67, para 3.5.4.4.4 line 3: Comment: Define UDRA in Section 6.1 Acronyms. Suggested Change: Rationale:	A
44	A	Page # 5, para # 3.1, line # 2: Comment: Incorrect reference paragraph on TBD combining technique. Suggested Change: Chang “Section 3.2.3” to read as “Section 3.3”. Rationale: Correctness.	AC: It will be changed to read as “Section 3.3.1”.
45	A	Page # 20, para # 3.2.3.1, line # 14: Comment: L1CI-code has not been defined throughout the document. Suggested Change: Change “L1CI-code” to read as “L1CD-code”. Rationale: Consistency.	A
46	A	Page # 22, para # 3.2.3.2 , line # 3: Comment: Unidentified “Figure 3-6”. Suggested Change: Change “Figure 3-6” to read as “Figure 3.2-4”. Rationale: Correctness.	A
47	A	Page # 56, para # 3.5.3.9.1, line # 1: Comment: Unidentified correction term “ISCL1CQ” and “ISCL1CI”. Suggested Change: Change “ISCL1CQ, and ISCL1CI” to read as “ISCL1CP, and ISCL1CD”. Rationale: Correctness.	A

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48	A	Page # 57, para # 3.5.3.9.2, line #: Comment: Add definition for “ISCL2C”. Suggested Change: Add “ISCL2C = see paragraph 30.3.3.3.1.1 of IS-GPS-200. Rationale: “ISCL2C” is not defined in IS-GPS-800, but in IS-GPS-200.	A
49	A	Page 46, Table 3.5-1 Subframe 2 Parameters (2 of 3) Change Cuc-n to Amplitude of the <u>cosine</u> ...	A
50	A	Where it appears: i_{0-n} -DOT, wouldn't it be better to call it IDOT? This would better match IS-GPS-200 and ICD-GPS-700A.	AC: Number of bits and scale factor are different between the two parameter.
51	A	Page 6, para 2, line 1: Comment: clarification Suggested Change: Change “common frequency source” to “frequency source common with L1 P(Y) and C/A” Rationale: Clarify what “common” applies to	AC: It will be changed to “frequency source common with other signals”.
52	A	Page 11, para 1, line 1: Comment: Recommend providing some reason for inserting the expansion sequence. Suggested Change: extend end of first sentence with a clause such as “to expand the 10222-bit Weil-code into a 10230-bit length code” Rationale: For clarity and spec maintenance	R: There are many different reasons and rationale, both technical and non-technical, for the design of L1C signal. This IS is not appropriate for such documentation. Other technical papers (i.e. ION paper) will be generated for such documentation.

The Class column stands for classification. Place C/S/A for each comment submitted, whenever possible. The classifications are:

CRITICAL: Refers to performance parameter issues/concept of operational employment, etc. Provide convincing support for your critical comment in the RATIONALE section.

SUBSTANTIVE: A section in the document appears to be, or is potentially unnecessary, incorrect, misleading, confusing, or inconsistent with other sections.

ADMINISTRATIVE: Typographical, format grammatical error(s).

Note: In the comments column place only one comment per row.

Note: Column 4, (A/AC/D/R), is for Document Sponsor use only, (Accept/Accept with Comment/Defer/Reject). This format will allow the document sponsor to A/AC/D/R each comment. Document sponsor comments will go in the same row next to the comment.

Note: Please use the format as shown. If you have General comments for the document that does not correspond to a page # place the words General for the page #. If there is no Para # or line # leave blank. If there is a figure on a page that you need to address place figure # instead of Para #.

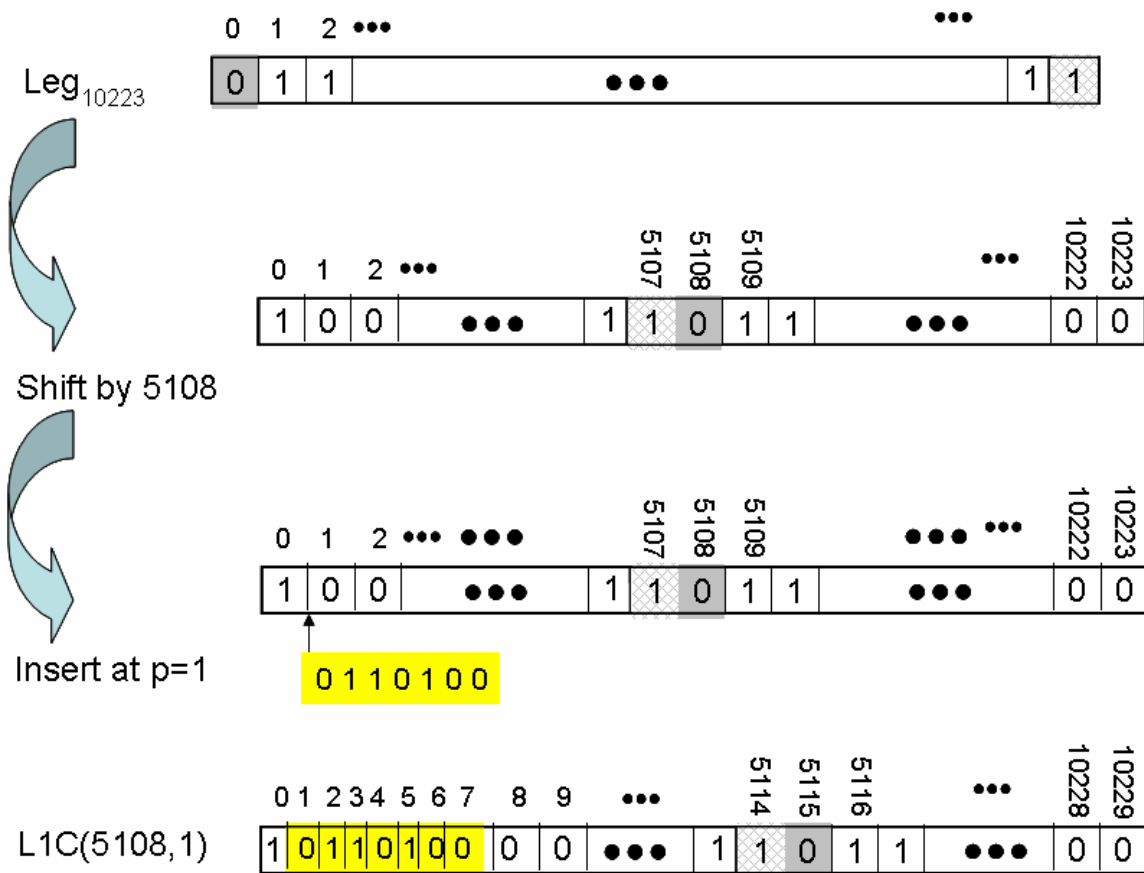


Figure 3.2 – 1A. Example GPS PRN L1Cp Signal Number 4